# A revision of *Muelleranthus*, *Ptychosema* and *Aenictophyton* (Fabaceae: Bossiaeeae)

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## Introduction

Tribe Bossiaeeae is a small tribe in family Fabaceae of herbaceous perennials, subshrubs and shrubs. The tribe is endemic to Australia and, as this study commenced comprised six genera and 72 species, 86% of these in *Bossiaea* Vent. The tribe has a widespread distribution in Australia, with the highest species richness in temperate and subtropical latitudes. Members of the Bossiaeeae can be recognised by the combination of their petals which are yellow or orange with red or purple-brown markings, their adaxially open staminal sheath, their uniform and dorsifixed anthers, and the distinctively lobed aril of their seeds. The current membership of the tribe was established in 1987 based on morphology (Crisp & Weston 1987) and a recent phylogenetic study by Crisp and Cook (2003) using molecular data supported this classification. Crisp and Cook's analyses also suggested that the Bossiaeeae is either sister to or nested within tribe Mirbelieae.

The subjects of this paper, the genera *Muelleranthus* Hutch., *Ptychosema* Benth., and *Aenictophyton* A.T.Lee., occur predominantly in arid or semi-arid regions. They are absent from Victoria and Tasmania. Both morphological and molecular analyses (Crisp & Weston 1987; Crisp & Cook 2003), suggest that they form a monophyletic group within the Bossiaeeae, with *Muelleranthus* sister to the other two. However, these molecular analyses only included a total of three species from the three genera.

*Taxonomic history*: *Ptychosema* and *P. pusillum* Benth. were described in 1839 (Bentham 1839). Subsequently *P. anomalum* F.Muell., *P. trifoliolatum* F.Muell. and *P. stipulare* J.M.Black were included in the same genus. The latter two species, which were distinct from *P. pusillum* in having trifoliolate rather than imparipinnate leaves, were transferred in 1973 to a new genus *Muelleranthus* (Hutchinson 1964). However, it was Lee (1973) who was the first to validly make combinations in this new genus. In the same article, Lee described *Muelleranthus crenulatus* A.T.Lee and erected a new monotypic genus *Aenictophyton* A.T.Lee to accommodate *A. reconditum* A.T.Lee.

## Abstract

A taxonomic revision of *Muelleronthus* Hutch., *Ptychosemo* Benth. and *Aenictophyton* A.T.Lee (Fabaceae: Bossiaeeae) is presented. All are Australian-endemic and species are found predominantly in arid or semi-arid regions. A new genus, *Parogoodio* I.Thomps., is erected to accommodate *Paragoodia crenulato* (A.T.Lee) I.Thomps., which is transferred from *Muelleranthus*. *Ptychosemo onomalum* F.Muell. is transferred to *Aenictophyton* and recombined as *Aenictophyton anomolum* (F.Muell.) I.Thomps. Two new species, *Muelleranthus porvolotus* I.Thomps. and *M. obovotus* I.Thomps, and one new subspecies, *Aenictophyton reconditum* subsp. *macrophyllum* I.Thomps., are described. Distribution maps and keys to species are presented. A revised key to genera in tribe Bossiaeeae is also presented.

***Keywords***: morphology, taxonomy, biodiversity, flowering plants, peas, legumes.

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## Methods

This morphological study utilised herbarium material which was examined with the aid of a dissecting microscope. Pressed flowers were reconstituted using hot soapy water to facilitate examination. Specimens from AD, BRI, CANB, MEL, NSW and PERTH were examined. All images presented were taken by the author using a Canon PowerShot A2000 IS digital camera.

## Results

The results of this morphological study are presented in the taxonomic section below. In summary, the pattern of morphological variation identified calls for the placement of *Muelleranthus crenulatus* in a new genus, the transfer of *Ptychosema anomalum* to *Aenictophyton*, and the recognition of two new species of *Muelleranthus* and one new subspecies of *Aenictophyton*.

Taxonomically useful characters identified for the four genera of the study group include: presence and density of indumentum and orientation of hairs; dimensions, shape and texture of stipules; number, length, shape and venation of leaflets; length and robustness of pedicels; number of flowers per raceme; dimensions of bracts, bracteoles and flower parts; the size and presence of a hypanthium; coloration of the petals; stipe length of pods; size, pigmentation, and suture morphology of pods; number of seeds per pod; and aril morphology.

This research forms part of a larger study encompassing all genera in tribe Bossiaeeae. Revisions of *Goodia* Salisb. and *Platylobium* Sm. have been published elsewhere in this volume of *Muelleria* (Thompson 2011a, 2011b).

## Taxonomy

### Tribe Bossiaeeae

*Herbaceous perennials, subshrubs or shrubs* to c. 4 m high, sometimes rhizomatous; branches terete or variously compressed. *Stipules* herbaceous or scarious, erect or variously recurved, caducous or persistent, fused to form a scale* at leafless nodes. *Leaves* alternate or opposite, imparipinnate, digitately or pinnately trifoliolate, or unifoliolate; sometimes plants leafless. *Inflorescences* terminal or pseudoaxillary, comprising few or many-flowered racemes, or flowers solitary; sometimes on very short branches bearing 2 to several bud scales; flowers pedicellate; bract and pair of bracteoles persistent or not. *Flowers* with hypanthium or not; calyx tubular, with upper lobes ±free or fused; petals clawed; standard and wing petals yellow or orange, mostly with red or purple-brown markings; wings generally narrower than the keel; keel angular or rounded apically, greenish or maroon; stamens generally all fused to form an adaxially open sheath; anthers all dorsifixed and of similar size; with connective mostly conspicuous. *Pods* short- to long-stipitate, moderately to strongly compressed, with a short beak, with upper suture sometimes ridged or winged; valves often becoming revolute post-dehiscence. *Seeds* generally plump, ellipsoid; aril with an arching vertical lobe.

*Scales which replace leaves in leafless species and bud scales are both formed by the fusion of a pair of stipules. Such scales occur in *Bossiaea* and *Platylobium* only.

### 1. *Paragoodia* I.Thomps., *gen. nov.*

*A* Goodia *Salisb. plantis prostratis herbaceis, foliolis crenulatis, bracteis et bracteolis persistentibus, racemis paucifloribus, leguminibus hirsutis differt; a* Muellerantho *Hutch. foliis pinnatim trifoliolatis, foliolis crenulatis, floribus sine hypanthio, leguminibus latioribus hirsutis, arillo majore differt.*

***Type***: *P. crenulata* (A.T.Lee) I.Thomps.

*Prostrate herbaceous perennials*, with a vertical rootstock (unknown whether this arises from a horizontal rhizome), sparsely pubescent; stems to 20 cm long, to c. 1 mm in diameter. *Stipules* lanceolate, thin, green at first. *Leaves* pinnately 3-foliolate, or digitately 3-foliolate in smaller leaves; petiole slender, not herbaceous, longer than the leaflets; leaflets with margin crenulate distally; upper surface gland-dotted; lower surface with secondary veins raised. *Inflorescences* terminal or pseudoaxillary (leaf-opposed), determinate, 1–3-flowered; bract and bracteoles persistent; bracteoles inserted distally on pedicel. *Flower-buds* with apex pointed; hypanthium not developed; calyx not striped; calyx-lobes much longer than tube, with apices filiform; upper lobes fused for most of length; lower lobes narrow-triangular, all of similar length or medial lobe slightly longer; petals with markings not of stripes; standard slightly longer than wings; wings c.

equal to keel; keel-apex c. rounded, red-brown; anther connective moderately broad; ovary 4-ovulate; stigma small. *Pods* with stipe shorter than calyx; body c. oblong, subtruncate basally, hairy, without markings. *Seeds*: aril well-developed, with lobe strongly curved.

***Notes***: The crenulate leaves and the relatively long, narrow calyx-lobes of the single species in *Paragoodia* are not seen in *Goodia*, *Muelleranthus*, *Aenictophyton* or *Ptychosema*; however, these features are seen in a few species of *Bossiaea* from Western Australia. *Paragoodia* resembles *Goodia* in having pinnately trifoliolate leaves, no hypanthium, and a similar pod shape and aril size. Also, the petal colour pattern is very similar to that of an undescribed species of *Goodia* from a nearby region in Western Australia (Thompson 2011a). However, *Paragoodia* differs from *Goodia* in its prostrate habit and few-flowered racemes. *Paragoodia* differs from *Muelleranthus* in having pinnately trifoliolate leaves, no hypanthium, relatively broad hairy pods, and seeds with a large aril.

***Etymology***: The genus name reflects the likely close relationship of the new genus to *Goodia* (From Latin: *para-*, beside).

### *Paragoodia crenulata* (A.T.Lee) I.Thomps., *comb. nov.*

*Muelleranthus crenulatus* A.T.Lee, *Contr. New South Wales Natl. Herb.* 4(7): 418 (1973)

***Type***: Western Australia. Eyre District: 13 miles [21 km] S of Mt Holland, E of Hyden, 119°45′ E, 32°22′ S, *A.S.George 9441*, vii.1969; holotype: PERTH01024205; isotype: NSW590548.

*Plants* with scattered spreading hairs c. 1 mm long. *Stipules* narrow-ovate to lanceolate, 2.5–5 mm long, 0.6–1.5 mm wide, with midrib prominent throughout, sometimes becoming stramineous. *Leaves* to c. 40 mm long; leaflets broad-cuneate, 3–9 mm long, 3–8 mm wide, with l:w ratio c. 1; apex broadly rounded to truncate, with apiculum distinct; margin crenulate in distal third with c. 6–12 crenulations; upper surface relatively sparsely haired or glabrous, green; lower surface with secondary veins conspicuously raised. *Inflorescences* 1–3-flowered; peduncle to c. 2 cm long; a filamentous, hairy axis-terminus often extending beyond ultimate pedicel insertion; rachis to c. 15 mm long; bract c. 3 mm long, c. 1 mm wide; pedicel 2–3 mm long, usually with spreading hairs; bracteoles 3 mm long,

**Key to genera in tribe Bossiaeeae**

1 Leaves unifoliolate (petiole not herbaceous) or not developed; inflorescences 1- or 2-flowered with 2 to several scales below; bracts and bracteoles generally brown, chartaceous like the scales ..... 2

1: Leaves 3–15-foliolate, or unifoliolate but then petiole herbaceous; inflorescences 1- to many-flowered, without scales below; bracts and bracteoles not brown and chartaceous ..... 3

2 Pods winged ..... ***Platylobium***

2: Pods not winged ..... ***Bossiaea***

3 Leaves unifoliolate or 5–15-foliolate ..... 4

3: Leaves trifoliolate ..... 5

4 Above-ground stems to c. 5 cm long; inflorescences of solitary flowers; hypanthium shorter than calyx-tube, not striped; keel-apex rounded and ciliolate ..... ***3. Ptychosema***

4: Above-ground stems mostly 10 to 70 cm long; inflorescences few to several-flowered; hypanthium c. as long as calyx tube, striped; keel-apex angular, not ciliolate ..... ***4. Aenictophyton***

5 Leaves digitately trifoliolate; pods mostly > 3 times as long as broad; aril < 0.8 mm long ..... ***2. Muelleranthus***

5: Leaves pinnately trifoliolate (rachis sometimes very short); pods < 3 times as long as broad; aril ≥ 0.8 mm long ..... 6

6 Erect shrubs; leaflets with margins entire; racemes several to many-flowered ..... ***Goodia***

6: Prostrate herbaceous perennials; leaflets crenulate distally; racemes 1–3-flowered ..... ***1. Paragoodia***

0.5–0.8 mm wide, inserted c. 1 mm below receptacle. *Calyx* 4–5 mm long, hairy; upper lobes fused for most of length; medial lower lobe slightly longer than lateral lower lobes; standard 8–10 mm long, c. 8 mm wide, red-brown over most of abaxial surface; wings 6 mm long, c. 2 mm wide, with auricle large, extending almost to receptacle; red-brown except near apex; keel 5.5 mm long, c. 3 mm wide, red-brown throughout; vexillary stamen less fused, sometimes becoming free; anthers c. 0.4 mm long; ovary 4-ovulate, style c. 3 mm long. *Pods*: stipe 2–3 mm long, body oblong, c. 10 mm long, 7 mm wide, rather flat, hairy; base broadly rounded, upper suture shallowly sulcate; apex obtuse to rounded, with beak 0.5 mm long; valves non-maculate. *Seeds* (only one seen) ellipsoid, 2.8 mm long, 2 mm wide, mid-brown (probably not mature colour), aril 0.8 mm long, 0.5 mm high, with lobe strongly curved.

***Specimens examined*: WESTERN AUSTRALIA** (All at type locality): *D.Bright s.n.*, 30.x.1996 (PERTH); *K.Kershow s.n.*, 8.vii.1998 (PERTH); *D.Bright & E.Bennett s.n.*, 29.x.1996 (PERTH).

***Flowering period***: Flowers winter.

***Distribution and habitat***: Known from a single locality south of Mt Holland in south-western Western Australia (Fig. 1). Grows in loam in mallee woodland.

***Notes***: *Paragoodia crenulata* are rare and very localised. Some features of its morphology are shown in figure 2. Images and information about this species, as *Muelleranthus crenulatus*, are presented in Lullfitz *et al.* (2008). The first few seedling leaves of *P. crenulata* are simple and crenulate *fide K.Kershaw* PERTH.

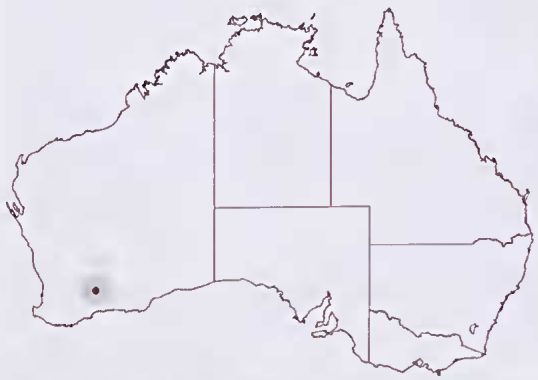

**Figure 1.** Distribution of *Poragoodio crenuloto* (shown by black dot; grey circle added to highlight its whereabouts).

## The *Muelleranthus-Ptychosema-Aenictophyton* Group

*Herbaceous perennials* or *green-stemmed shrubs*, prostrate to erect, to c. 1 m high, resprouting from vertical rootstock and/or horizontal rhizomes; branches terete. *Stipules* erect, generally herbaceous at first, generally persistent. *Leaves* alternate; leaflets entire, commonly concave or folded, with base generally cuneate. *Inflorescences* not subtended by scales, terminal or pseudoaxillary (leaf-opposed), solitary or up to c. 10-flowered. Bracts and bracteoles generally persisting to flowering. *Flowers* with a hypanthium; calyx-tube equal to or shorter than lobes; upper lobes of calyx c. equal in length to lower and only a little broader, variably fused; petal markings often comprising stripes or flecks. *Pods* narrow-oblong or narrow-elliptic,

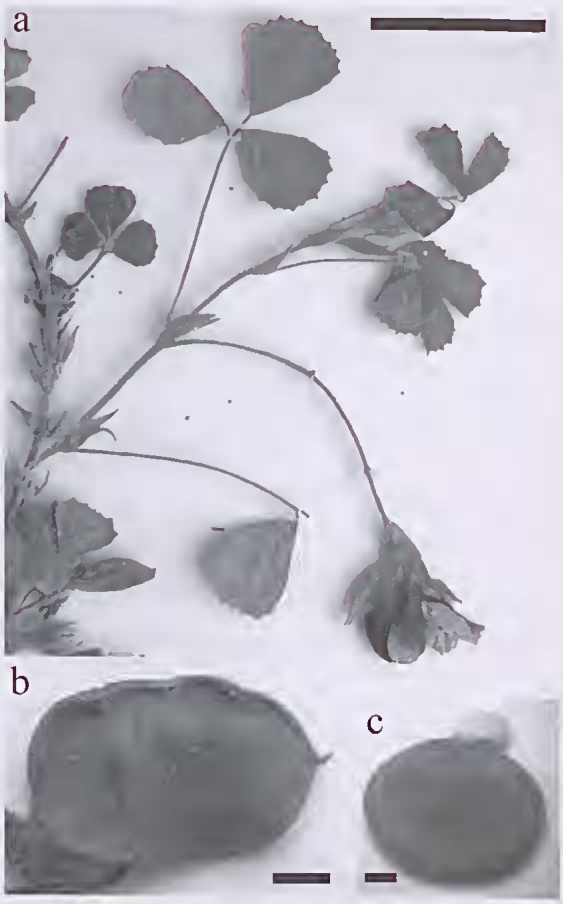


**Figure 2.** *Poragoodia crenuloto*, a. portion of plant with flowers and buds (*K.Kershaw s.n.* PERTH), b. pod, c. seed (b & c. *D.Bright & E.Bennett s.n.* PERTH). Scale bars: a = 10 mm, b = 2 mm, c = 0.5 mm.

glabrous, not or hardly winged. *Aril* small or absent.

*Notes*: The petal markings in this group have two components, one that gives a red colour (reddish when petal dry) and the other which produces a purple-brown colour (purple when dried). The red pigmentation is commonly present each side of the throat of the standard flare and also at the apex of the keel. Microscopic examination shows this colour to be uniformly infused in the petal tissue. The purple-brown pigmentation is more widely distributed, and is commonly extensive over the abaxial surface of the standard. It can be present on all petals and is responsible for the characteristic stripes and flecks seen in petals of species in this group. Microscopic examination shows that this marking is created by minute densely pigmented dots.

## 2. *Muelleranthus* Hutch., *Gen. Fl. Pl.* 1: 361 (1964)

***Type***: *M. trifoliolatus* (F.Muell.) Hutch. ex A.T.Lee

*Prostrate herbaceous perennials*, to c. 3 cm high, with a vertical rootstock (unknown if horizontal rhizome present); above-ground parts glabrous or variously pubescent; stems to c. 60 cm long, to c. 1 mm in diameter. *Stipules* broad-ovate to lanceolate, slightly fleshy, green. *Leaves* digitately 3-foliolate, to c. 40 mm long, petiole slender, not herbaceous, longer than the leaflets; leaflets broad-cuneate, obcordate or obovate, flat, concave or conduplicate, somewhat fleshy; upper surface gland-dotted; lower surface with secondary veins generally not raised. *Inflorescences* pseudoaxillary (leaf-opposed), determinate, 1–3-flowered; bracts and bracteoles generally persistent; bracteoles inserted distally on pedicel. *Flower-buds* with a rounded apex; hypanthium short, obconical, generally with raised nerves; hypanthium and calyx lacking longitudinal stripes; calyx-lobes equal to or longer than tube, with apices not filiform; upper lobes fused for ½ or more of length; lower lobes oblong-ovate; standard shorter than, equal to or longer than other petals; wings equal to or shorter than keel; standard with red-brown markings only, wings and keel variously marked red-brown; keel-apex c. rounded, sometimes marked red; anther connective moderately broad; ovary 5–12-ovulate; stigma small. *Pods* with stipe mostly shorter than calyx; body generally narrow-oblong in profile, rarely minutely winged, with a beak to c. 1 mm long; valves sometimes maculate. *Seeds*: aril small, with lobe strongly curved, or not developed.

### 2a. *Muelleranthus trifoliolatus* (F.Muell.) Hutch. ex A.T.Lee, *Contr. New South Wales Natl. Herb.* 4(7): 418 (1973)

*Ptychosema trifoliolatum* F.Muell., *S. Sci. Rec.* 2: 72 (1882).

***Type***: Western Australia. Upper Murchison River, *Gale*, 1881; holotype: MEL26470.

*Plants* with sparse to scattered appressed or occasionally spreading hairs c. 0.3 mm long. *Stipules* narrow-ovate to broad-ovate or c. orbicular, 2–5 mm long, 1.5–4 mm wide, with midrib generally distinct. *Leaves*: lamina of leaflets cuneate to obcordate, 2–8 mm long, 2–8 mm wide, with l:w ratio 0.8–1.2; apex truncate, retuse or bilobed, with apiculum absent or minute; margin entire; upper surface green, sometimes with glands dark, glabrous or hairy; lower surface with secondary veins often faintly evident. *Inflorescences* 1, 2- or rarely 3-flowered; peduncle to 3.5 cm long; bract 2–4 mm long, 1–2 mm wide; pedicel 1.5–5 mm long, with spreading hairs; bracteoles 2–3 mm long, 0.7–1 mm wide, inserted c. 1 mm below receptacle. *Hypanthium* 0.5–1 mm long; calyx 3–5.5 mm long, glabrous, with lobes slightly longer than tube; upper lobes fused for most of length; standard 8–15 mm long, 8–12 mm wide, with flare broad, not or only slightly red-brown beyond flare abaxially; wings 7–12 mm long, 2–3 mm wide, variably red-brown in proximal ⅔, yellow apically; keel 7–12 mm long, 3.5–5 mm wide, patchily to entirely red-brown, generally with a distinct red apex (drying pink); anthers c. 0.5 mm long; ovary 8–12-ovulate, style c. 3 mm long. *Pods*: stipe 2–3 mm long, body narrow-oblong, 15–25 mm long, 3.5–5.5 mm wide; upper suture not winged; valves usually with dark red-brown blotches. *Seeds* ellipsoid, 2–2.5 mm long, red-brown, mottled blackish; aril 0.2 mm long, 0.2 mm high, with aril-lobe curved.

***Selected specimens of c. 40 examined*: WESTERN AUSTRALIA**: W of homestead, Mt Narryer Station, *A.S.George 17553*, 19.viii.1999 (CANB, DNA, PERTH); c. 43 km NW of Belele Homestead, *N.H.Speck 646*, 5.ix.1957 (CANB, PERTH); 13 km W of

Meekatharra, *N.H.Speck 598*, 4.ix.1957 (CANB, PERTH); Murgoo Station, NE of Mullewa, *A.M.Ashby 2547*, 17.viii.1968 (PERTH); Whalloo Rocks, Coodardy Station, NW of Cue, *A.R.Main*, 12.ix.1968 (PERTH); Gascoyne R., Junta Junta, *C.A.Gardner 6090*, 21.ix.1941 (PERTH); c. 46 km W of Mt Magnet, *A.S.George 7963*, 11.ix.1966 (PERTH); Nallan, N of Cue, *C.A.Gardner 7833*, 6.x.1943 (PERTH); Ballan Rock near Mt Magnet, *R.Bates 3987*, 1.ix.1984 (PERTH); 2 km NNE of Randall Bore, Yarlarweelor Station, *R.J.Cranfield 5592*, 10.viii.1986 (PERTH); SW of Mt Gould, boundary Shire of Murchison, *A.E.de Jong 80334.2*, 5.viii.1992 (PERTH); Mullewa–Carnarvon Rd at 63.3 km S of turnoff to Glenburgh homestead, just S of No. 16 well, *S.Patrick & A.Cochrane 3665*, 10.viii.2000 (PERTH); 17 km N of road junction of Murgoo, Wooleen and Boolardy Rds, *A.M.Ashby 5046* (AD); 6.4 km S of Bore no. 3, Talisker Station, Carnarvon Botanical District, *R.J.Chinnock 6748*, 15.viii.1986 (AD, BRI, PERTH); Boolardy Station, Murchison River, *C.A.Gardner*, 30.vii.1927 (PERTH).

***Flowering period*:** Flowers mostly winter–spring.

***Distribution and habitat*:** Occurs largely inland in north-western Western Australia (Fig. 3). Grows in red sand in Mulga woodland and scrub.

***Notes*:** *Muelleronthus trifoliolotus* is sympatric with *M. obovatus*, and mixed collections have been recorded from Boolardy Station (*Gordner* PERTH). Flowers, a leaf and a pod of *M. trifoliolotus* are shown in figure 4e–g. Specimens from the Mt Magnet area are smaller in most parts; especially the leaves.

The circumscription of *M. trifoliolatus* has been markedly altered in this revision compared to that of Lee (1973), with *M. porvolotus* and *M. obovatus* segregated as new species and several specimens reassigned to *M. stipuloris*. Consequently the distribution of *M. trifoliolotus* is now far more restricted than that described in recent floras.

A sheet bearing *M. trifoliolotus*, MEL 26471, was cited as an isotype by Lee (1973); however, there is no evidence that this material was collected by Gale.

### 2b. *Muelleranthus obovatus* **I.Thomps.**, *sp. nov.*

*A* M. trifoliolato *(F.Muell.) Hutch. ex A.T.Lee foliolis et stipulis ongustioribus, foliolis obovatis, floribus minoribus, leguminibus brevioribus 4–5-seminalis differt.*

***Type*:** Western Australia. Peak Bore, *T.L.Setter 353*, 16.ix.1973; holotype: PERTH06378307; isotype: AD.

*Plonts* with very few, mostly appressed hairs 0.2–0.3 mm long. *Stipules* narrow-ovate to lanceolate, 1.5–4 mm long, 0.7–2 mm wide, with midrib generally distinct. *Leaves*: lamina of leaflets cuneate-obovate to obovate, or occasionally cuneate, 3–10 mm long, 1.5–6 mm wide, with l:w ratio mostly 1.2–2.2, apex broadly rounded to truncate, less often slightly retuse, with apiculum minute or absent; margin entire; upper surface green, commonly glabrous; lower surface with secondary veins not evident. *Inflorescences* 1(or 2)-flowered; peduncle to 4 cm long; bract 2–3 mm long, 0.5 mm wide; pedicel 4–6 mm long, with spreading hairs; bracteoles 1–2 mm long, 0.2–0.5 mm wide, inserted 1–2 mm below receptacle. *Hypanthium* c. 0.5 mm long; calyx 2–3 mm long, glabrous, with lobes c. equal to tube; upper lobes fused for most of length; standard 4–6 mm long, c. 5 mm wide, with flare moderately broad, abaxially variably red-brown; wings 3–5 mm long, 1–1.5 mm wide, yellow, sometimes red-brown centrally; keel 4–6 mm long, 2.5 mm wide, pale throughout or flecked red-brown; anthers 0.3–0.4 mm long; ovary 5- or 6-ovulate, style 1–1.5 mm long. *Pods*: stipe 2–4 mm long, body narrow-oblong, 10–17 mm long, 4–5 mm wide; upper suture commonly thinly and

**Key to species of *Muelleranthus***

1 Wings red-brown throughout (purple when dry) or at least distally; aril absent; standard 4–5 mm long ..... **2d. *M. stipularis***

1: Wings yellow throughout or at least distally; aril present; standard 4–15 mm long ..... **2**

2 Wings 3–5 mm shorter than keel; standard shorter than keel, with adaxial flare c. 0.3 mm wide; pedicels glabrous or with few appressed hairs ..... **2c. *M. parvalatus***

2: Wings 0–1 mm shorter than keel; standard equal to or longer than keel, with adaxial flare c. 1 mm wide; pedicels bristly with spreading hairs ..... **3**

3 Keel 4–6 mm long; pods 4–6-seeded, usually lacking macules, often slightly winged along upper suture; leaflet-lamina longer than broad, with apex mostly rounded or rounded-truncate ..... **2b. *M. obovatus***

3: Keel 7–12 mm long; pods mostly 7–10-seeded, usually conspicuously maculate, not winged; leaflet-lamina c. as broad as long, with apex mostly truncate or truncate-emarginate ..... **2a. *M. trifaliolatus***

minutely winged; valves lacking red-brown blotches or rarely a few blotches evident. *Seeds* (not seen mature), ellipsoid, c. 2.5 mm long, red-brown when semi-mature; aril 0.2 mm long, 0.2 mm high, with aril-lobe curved.

***Selected specimens of 10 examined*: WESTERN AUSTRALIA:** ExSB 113, Pongo Paddock, Towera Station, 23°10 115°15, *R.J.Cranfield 1815*, 6.viii.1981 (PERTH); Boolardy station, *A.W.Humphries*, 21.ix.1950 (PERTH); 2 km NE of Towrana Homestead, *R.J.Cranfield 2184*, 30.iv.1982 (PERTH); 1.5 km E of Middle Blue Hills, well, Milly Milly Station, *R.J.Cranfield 5335*, 24.iv.1986 (PERTH); 9 km 5SE of Meegea Hill, Milly Milly Station, *R.J.Cranfield 9753*, 9.v.1995 (CANB, PERTH); Boolardy Station, Murchison River, *C.A.Gardner*, 30.vii.1927 (PERTH).

***Flowering period*:** Flowers autumn, winter and early spring.

***Distribution and habitat*:** Occurs in far north-western Western Australia (Fig. 3). Grows in sandy soils in open woodland.

***Etymology*:** The epithet refers to the typical shape of the leaflets (From Latin: *obovatus*, obovate).

***Notes*:** *Muelleranthus obovatus* is distinguished from other species of the genus by its leaflets which are obovate with a relatively high length to width ratio and a rounded apex (Fig. 4a–b), and its long pedicels. The absolute and relative length of the petals are also diagnostic (Fig. 4c). Compared to *M. trifoliolatus*, with which it is sympatric, it also has narrower stipules, bracts and bracteoles, smaller flowers and shorter and fewer-seeded pods with valves generally lacking red-brown blotches (Fig. 4d). Although the valves of the pod are not generally maculate, a rudimentary wing above the sutural nerve often has red-brown streaks. *Muelleranthus obovatus* and *M. trifoliolatus* have a similar indumentum including a distinctive patch of spreading hairs on the pedicels.

### 2c. *Muelleranthus parvalatus* **I.Thomps.**, *sp. nov.*

*A* M. trifoliolato *(F.Muell.) Hutch. ex A.T.Lee stipulis angustioribus, pilis pedicellorum appressis, vexillo breviore, alis minoribus comparate luteis magnopere differt.*

***Type*:** Northern Territory. Near Chilla Wells Bore, Tanami Desert Wildlife sanctuary, Tanami Track, c. 390 km NW of Alice Springs, *A.C.Beauglehole 50485*, 16.v.1976; holotype: MEL2100375; isotype: DNA169493.

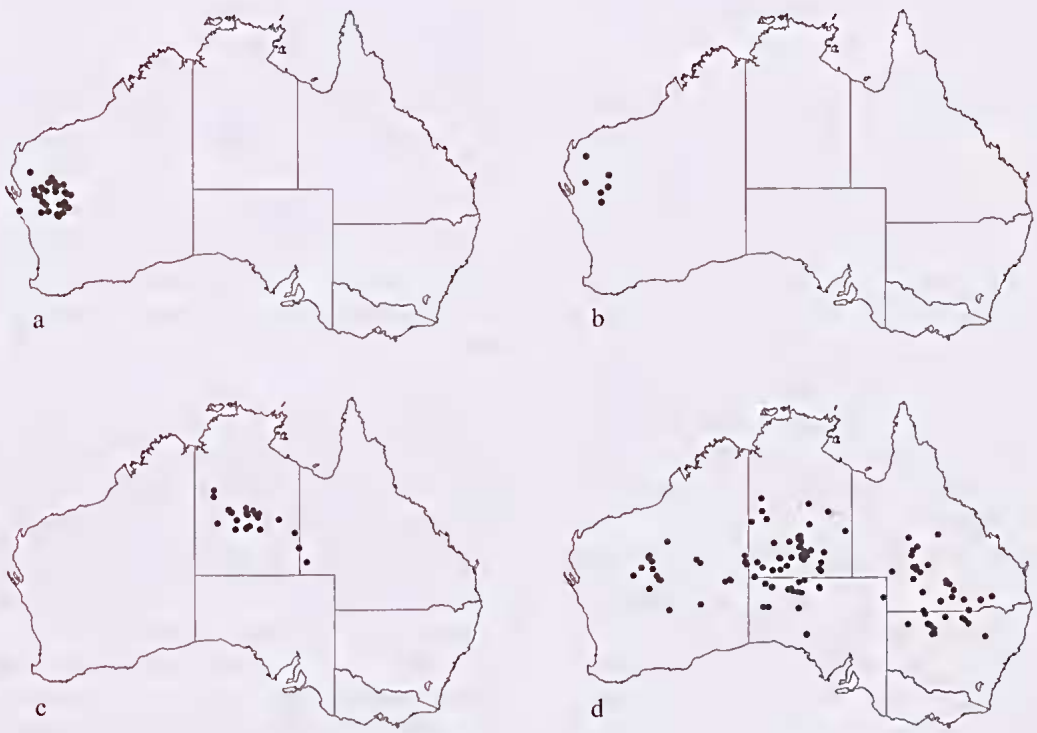


**Figure 3**. Distributions of a. *Muelleranthus trifalialatus*, b. *M. abavatus*, c. *M. parvalatus*, and d. *M. stipularis*.

*Plants* very sparsely haired with appressed hairs c. 0.2 mm long. *Stipules* narrow-ovate to lanceolate, 1.5–3 mm long, 0.5–1.5 mm wide, with midrib generally distinct. *Leaves*: lamina of leaflets cuneate-obovate or obcordate, 3–6 mm long, 2–5 mm wide, with l:w ratio 1–1.4; apex truncate, retuse or bilobed, not apiculate; upper surface sometimes with dark glands, glabrous; lower surface with secondary veins not evident. *Inflorescences* 1(or 2)-flowered; peduncle 1–3 cm long; bract 1–2 mm long, 0.7 mm wide; pedicel 1–3 mm long, glabrous or with appressed hairs; bracteoles 1–2 mm long, 0.3 mm wide, inserted c. 1 mm below receptacle. *Hypanthium* c. 0.5 mm long; calyx 3–4 mm long, glabrous, with lobes longer than tube; upper lobes fused for c. half of length; sta ndard 6–10 mm long, 6–8 mm wide, with flare narrow, usually flecked red-brown abaxially; wings 4.5–7 mm long, 1.5–2 mm wide, all yellow or with a red-brown patch proximally; keel 7–12 mm long, 4–5 mm wide, usually with red-brown flecks throughout; anthers c. 0.6 mm long; ovary 8–12-ovulate, style 2.5–3 mm long. *Pods*: stipe 2–3 mm long, body narrow-oblong, 15–25 mm long, 3.5–4.5 mm wide; upper sutures not winged; valves sometimes faintly spotted. *Seeds* irregularly ellipsoid, 2–2.8 mm long, red-brown, sometimes lightly mottled, aril minute but with lobe distinct.

***Selected specimens of c. 20 examined*: NORTHERN TERRITORY**: Curlew Waterhole, Lander R., c. 100 km NW of Willowra homestead, *G.Chippendale 4805*, 31.vii.1958 (AD, CANB, DNA, NSW, PERTH); c. 3 km E of Wycliffe Creek crossing, Stuart Hwy, *D.J.Nelson 692*, 30.iv.1963 (AD, CANB, DNA, NSW); 7 km WSW No. 3 Bore, Manners Creek Station, *D.E.Albrecht 6318*, 21.iii.1995 (DNA, MEL279975); Stirling Swamp, *P.K.Latz 5605*, 3.vii.1974 (CANB, BRI, DNA); 10 km from Warrabri Aboriginal Settlement towards "Murray Downs", *N.Ollerenshaw 575*, 27.i.1982 (CANB); Around Parnta outstation, 35 km S of Lajamanu, *K.G.Brennan 6007*, 10.x.2003 (DNA). **QUEENSLAND**: Mulligans River, *W.A.Cornish*, 1885 (MEL26469).

***Flowering period***: Flowers most times of year in response to rainfall.

***Distribution and habitat***: Occurs in the Northern Territory and in far south-western Queensland (Fig. 3). Grows adjacent to watercourses and swamps.

***Etymology***: The epithet refers to the relatively small wing petals (From Latin: *parvus*, small and *alatus*, winged).

***Notes***: The keel of *M. parvalatus*, and to a lesser extent the standard, are distinctively speckled purple-brown, and the wings are relatively short and entirely or mostly yellow (Fig. 4j). The standard claw is conspicuously cuneate as is the limb. *Muelleranthus parvalatus* is similar to *M. trifoliolatus* but, in addition to the differences indicated in the key, has a lower proportion of 2-flowered racemes, shorter pedicels, and pod valves that lack maculations. Glabrous forms of *M. stipularis* vegetatively resemble *M. parvalatus*. *Muelleranthus parvalatus* can be distinguished in the fruiting period by the persistent style and stamens, which are shorter.

*Muelleranthus trifoliolatus*, *M. obovatus* and *M. parvalatus* form a group based on similarities in floral structure and aril development. The seed of *M. parvalatus* is shown in figure 4k and habit is shown in figure 4i.

The illustrations and much of the description of *M. trifoliolatus* in *Flora of Central Australia* (Crisp 1981) correspond to *M. parvalatus*.

### 2d. *Muelleranthus stipularis* (J.M.Black) A.T.Lee, *Contr. New South Wales Natl. Herb.* 4(7): 418 (1973)

*Ptychosema stipulare* J.M.Black, *Trans. Roy. Soc. South Australia* 62(1): 103 (1938).

***Type***: Northern Territory. Bundooma, *J.B.Cleland*, 8.viii.1936; holotype: AD97221313; isotype: AD95830040, MEL26465, K000278104, image seen on-line.

*Muelleranthus trifoliolatus sensu* A.T.Lee, *Contr. New South Wales Natl. Herb.* 4(7): 418 (1973), *pro parte*; *sensu* T.A.James (1991, 2002 revised edn), as *M. trifoliatus*, in G.J.Harden (ed.), *Fl. New South Wales* 2: 511–512, *pro parte*.

*Prostrate to weakly erect plants* with a dense indumentum of spreading or subappressed hairs to c. 1 mm long, or with a sparse to scattered indumentum of appressed hairs 0.3–0.7 mm long, or plants quite glabrous. *Stipules* narrow-ovate to broad-ovate, elliptic or c. orbicular, 2–6 mm long, 1–6 mm wide, with abaxial venation generally indistinct, usually with 2 or more veins evident proximally. *Leaves*: lamina of leaflets cuneate, slightly obcordate or obovate, 2–10 mm long, 2–7 mm wide, with l:w ratio 1–1.7; apex broadly rounded, truncate or slightly retuse, apiculum absent or small;

margin entire; upper surface often reddish, hairy or less often glabrous; lower surface with secondary veins not evident. *Inflorescences* 1(or 2)-flowered; peduncle to 5 cm long; bract 2–4 mm long, 0.5–1 mm wide; pedicel 1–2.5 mm long; bracteoles 1–3 mm long, 0.2–0.6 mm wide, inserted c. 0.5 mm below receptacle. *Hypanthium* c. 0.5 mm long; calyx 3–4 mm long, glabrous or hairy, with lobes equal to or longer than tube; upper lobes fused for c. half of length; standard 4–6 mm long, c. 5 mm wide, adaxially red-brown, abaxially red-brown or speckled red-brown but pale along nerves; wings 3–4 mm long, c. 1 mm wide, entirely red-brown; keel 4–7 mm long, 2–2.5 mm wide, greenish-yellow; anthers 0.3 mm long; ovary 4–10-ovulate, style 1–2 mm long. *Pods*: stipe 2–3 mm long, body narrow-oblong or narrow oblong-elliptic, 17–30 mm long, 5–7 mm wide, upper suture not winged; valves occasionally with a few dark red-brown blotches. *Seeds* ellipsoid to globular, 2–3 mm long, brown, often complexly mottled cream-yellow and/or blackish; aril not developed.

***Selected specimens of c. 50 examined*: WESTERN AUSTRALIA: subglabrous form:** 120 km N of Meekatharra, *D.E.Symon 9984*, 15.v.1975 (AD, CAN8, NSW, PERTH); Little Sandy Desert, 7.4 km ENE of Cooma Well, 43.6 km NNW of Yanneri Lake, *S. van Leeuwen 3152*, 13.viii.1997 (8RI, MEL2308777, PERTH); 8elow trig point M6, southern Carnarvon Range, Little Sandy Desert, *K.F.Kenneally & D.J.Edinger K 12224 E 2689*, 6.viii.2001 (PERTH); c. 147 km NE of Wiluna, *A.S.George 5602*, 28.vii.1963 (PERTH); Plot 311, Lorna Glen, *T.8ragg 2004-31*, 11.viii.2004 (PERTH); 19.9. km SE of Yanneri Lake, Great Sandy Desert, *S.van Leeuwen 4967*, 18.viii.2001 (8RI, PERTH); Sir Frederick Range, *D.Symon 2306*, 1.viii.1962 (AD); **glabrous form:** Near Mt Squires, 8arrow Range, *R.Helms*, viii.1891 (MEL). **NORTHERN TERRITORY: glabrous or sparsely haired form:** 30 km ESE of Neutral Junction Homestead, *D.E.Albrecht & P.K.Lotz 12762*, 27.ii.2009 (DNA); 81 km S of Hookers Creek settlement, *G.Chippendole 2296*, 13.vii.19S6 (AD, DNA); **hairy form:** 8onny Creek, 80.S km S of Tennant Creek, *N.Wolker*, 23.viii.1966 (AD); 8 km NE of Angas Downs on road to Wallara Ranch, *8.G.8riggs 7164*, 30.ix.1979 (NSW). **SOUTH AUSTRALIA: hairy form:** Mt Sarah Station, Lake Eyre region, *R.J.Bates 51194*, 30.ix.1998 (AD); 0.8 km SE of Mt Finke trig., *D.E.Symon 1262*, 7.x.1987 (AD); Mt Kintore sandhills, *R.Botes 58210*, 27.iv.2001 (AD); c. 2 km N of Marla, *P.J.Lang, P.D.Canty & A.C.Robinson BSOP-468*, 22.v.2000 (AD); Everard Ranges, *A.G.Spooner 108*, 10.ix.1968 (AD, NSW). **QUEENSLAND: hairy form:** c. 10 km W of Moonie, *L.Pedley 1051*, 18.ix.1962 (8RI); 69 km NE of Aramac, *E.J.Thompson GAL356*, 22.iii.2000 (AD, BRI, NSW); "Top Crossing" c. 30 km S of Winton, *K.P.Nicolson 387*, 20.viii.1988 (8RI); Currawinya National Park, boundary track S of Salt 8ore, *P.I.Forster 20534 & M.Watson*, 21.iii.1997 (8RI, MEL2496S9, NSW); Idalia National Park, Reedy Springs W of 8ulloo R., *P.I.Forster 18871 & T.Ryon & C.Morgan*, 14.iii.1996 (8RI); **glabrous form:** 1S km S of Charleville along road to Wyandra, *R.W.Purdie & D.E.8oylond 236*, 26.iii.1976 (BRI); 89.6 km W of St George, *A.R.Bean 25502*, 26.viii.2006 (8RI); c. 38 km SE of Charleville on road to 8ollon, *B.J.Lepschi & A.V.Slee 1105*, 12.x.1993 (CAN8); c. S8 km W of Roma, *N.C.W.8eodle*, 1S.v.1963 (NSW). **NEW SOUTH WALES: hairy form:** Kurrajong Station near Glengarry Opalfield, c. 100 km NE of Brewarrina, *J.Thompson 2110*, 3.ix.1974 (NSW); 1.8 km N of Cumborah towards Lightning Ridge, *A.R.8ean 22914*, 14.ix.2004 (8RI); 16 km W of Tundulya, 37 km S of Louth, *J.Pickard 2012*, 22.iii.1973 (NSW); **glabrous form:** Pulpulla near Cobar, *H.Andra*, 188S (MEL).

***Flowering period*:** Flowers at various times depending on rainfall.

***Distribution and habitat*:** Occurs in central and eastern Western Australia, the Northern Territory, western Queensland and north-western New South Wales (Fig. 3). Grows in sandy soils in woodland and grassland.

***Notes*:** *Muelleranthus stipularis* is distinguished by the short petals with a distinctive colour pattern and the lack of an aril on the seed (Fig. 4l–m). Plants are often but not always conspicuously hairy with spreading hairs, and have large rotund stipules. Such plants are immediately identifiable as *M. stipularis*.

Most of the glabrous collections are from the Maranoa and Warrego districts of southern Queensland. In Queensland, plants generally have longer bracts, bracteoles and pods, and pods generally contain more seeds. In New South Wales a few specimens have a moderately dense indumentum of short appressed hairs. In north-central Western Australia a form with a very sparse indumentum of appressed hairs predominates, and leaflets of this form are usually relatively small.

A sparsely haired specimen from the Northern Territory (*D.E.Albrecht & P.K.Latz 12762* DNA); is somewhat distinctive in its combination of stouter branches, more erect habit, large leaflets, slender stipules, and a relatively long keel. Further investigation is needed to determine if it warrants taxonomic recognition.

*Muelleranthus stipularis* is the most widespread species in the genus. Its distribution overlaps that of


**Figure 4.** *Muelleranthus*. a–d. *M. obavatus*: a. partian *af* holotype (*T.L.Setter 353* PERTH), b. leaf (*R.J.Cranfield 9753* PERTH), c. flower, d. pod (c. & d. *R.J.Cranfield 1815* PERTH). e–h. *M. trifalialatus*, e. leaf (*B.Maslin 5176* PERTH), f. inflarescence (*S.J.J.Davies s.n.* PERTH), g. flower (*S.Graham 5* PERTH), h. pod (*H.Demarz D5679* PERTH). i–k. *M. parvalatus*, i. habit, j. flower (i & j. *I.D.Cowie & P.S.Brocklehurst 10235* DNA), k. seed (*Hill 306* MEL). l–m. *M. stipularis*, l. flower (*P.Martensz 2734* CANB), m. seed (*J.Maconochie 1388 CANB*). Scale bars: a, i = 10 mm, b, c, e–g, j, l = 2 mm, d, h = 5 mm, k, m = 0.5 mm.

*M. parvalatus* in central Australia and *M. trifoliolatus* in central Western Australia. Lee (1973) placed specimens of *M. stipularis* with a sparse indumentum from Queensland, New South Wales and the Northern Territory in *M. trifoliolatus*, and this has subsequently caused some confusion in identification.

Lee (1973) incorrectly designated AD 95830040 as the holotype of *P. anomalum*. This material came from the herbarium of the collector J.B. Cleland and was unlikely to have been used by Black when describing the new species. Lee appears not to have been aware of the existence of the material used by Black which is now mounted on sheet AD 97221313.

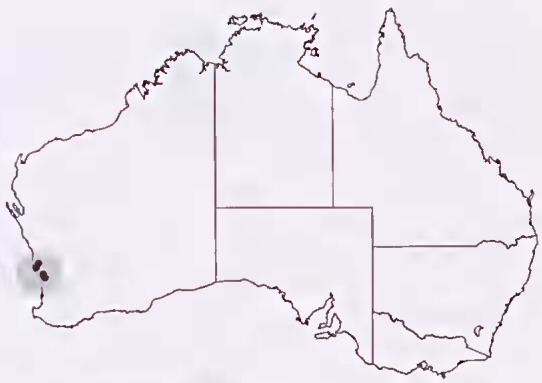

**Figure 5.** Distribution of *Ptychosema pusillum* (shown by black dots; grey circle added to highlight their whereabouts).

## 3. *Ptychosema* Benth., *in* J.Lindley, *Edwards's Bot. Reg.*, app. to vols 1–23, xvi (1839)

***Type***: *P. pusillum* Benth.

*Dwarf herbaceous perennials* to c. 8 cm high, with underground stems rising vertically from deep horizontal rhizomes; above-ground parts sparsely pubescent; branches to c. 0.7 mm in diameter. *Stipules* narrow-lanceolate, fleshy, green. *Leaves* imparipinnate, with petiole and rachis sub-herbaceous, not fleshy; petiole generally longer than leaflets but shorter than rachis; leaflets generally much longer than broad; upper surface not dotted with glands; lower surface with secondary veins raised. *Inflorescences* of a solitary terminal flower; a rudimentary axis-terminus sometimes evident opposite bract; bract and bracteoles persistent; bracteoles inserted c. mid-pedicel or more distally. *Flower-buds* not or only minutely pointed at apex; hypanthium obconical, with nerves obscure; hypanthium and calyx not striped; calyx-lobes c. equal to tube, with apices often shortly filiform; upper lobes fused for most of length; lower lobes ±triangular; standard clearly longer than wings, wings longer than keel; standard with red-brown stripes abaxially, wings and keel variously marked reddish; keel c. rounded at apex; anther connective slender; ovary glabrous, ovules per ovary unknown; stigma large. Pods and seeds unknown.

***Notes***: There have been three taxa included with *P. pusillum* in *Ptychosema* since the genus was erected. Two of these, *Ptychosema trifoliolatum* and *P. stipulare*, were transferred to *Muelleranthus* in 1973, while in this paper *P. anomalum* is transferred to *Aenictophyton*. Thus, *P. pusillum* has been returned to its original status as a monotypic genus. *Ptychosema* is likely to be most closely related to *Aenictophyton* based on the herbaceous petiole and rachis of the leaves and its growth from deep horizontal rhizomes. The last of these characters has not been recorded in *Muelleranthus* and *Paragoodia*, but there is insufficient knowlege of underground parts of these genera to rule out their presence.

### *Ptychosema pusillum* Benth., *in* J.Lindley, *Edwards's Bot. Reg.*, app. to vols 1–23, xvi (1839)

***Type***: Western Australia. Swan River, *J.Drummond s.n.*; holotype: K000278107 *n.v.*, image seen in Kew herbarium catalogue on-line.

*Plants* to c. 3 cm high excluding inflorescences, with scattered appressed or spreading coarse hairs mostly 0.5–1 mm long; stems to c. 0.7 mm in diameter. *Stipules* narrow-lanceolate to linear, 1–2.5 mm long, 0.1–0.4 mm wide. *Leaves* 5–13-foliolate, to c. 40 mm long; petiole 5–10 mm long, not thicker than pulvinus; rachis slightly green, 0.3–0.4 mm in diameter, not fleshy; leaflets occasionally sub-opposite, obovate to narrow-oblanceolate, narrow-cuneate or appearing narrow-oblong to linear when folded, 4–10 mm long; upper surface glabrous; lower surface with secondary veins conspicuously raised. *Flowers* solitary; peduncle 20–50 mm long; bract narrow-ovate, 2 mm long, c. 1 mm wide; pedicels 10–12 mm long; bracteoles c. 2

**Figure 6.** *Ptychosema pusillum* (*A.P.Brown 1013* PERTH). Actual size

mm long, 0.5–0.8 mm wide, inserted 3–8 mm below receptacle. *Hypanthium* obconical, 1–1.5 mm long; calyx 5–6 mm long, with appressed hairs; lobes c. as long as tube; upper lobes fused for most of length forming a truncate upper lip with laterally directed filiform points; lower lobes with filiform apices; standard 10–18 mm long, c. 10–18 mm wide, with a moderately broad flare, red-brown abaxially except for nerves, wings 8–12 mm long, c. 3 mm wide, with limb decurved, entirely reddish, keel 7–10 mm long, c. 3.5 mm wide, red-brown streaks not quite extending to a green apex, densely ciliolate apically; anthers 0.5 mm long; style c. 1 mm long, stigma very large. *Pods and seeds* not seen.

***Specimens examined***: **WESTERN AUSTRALIA**. Near Badgingarra, *E.A.Griffin*, date unknown (PERTH03510263); Lake Guraga, *A.P.Brown 1013*, 30.viii.1992 (PERTH); Beerera NR, *G.Keighery*, 5.x.2010 (MEL); Locality unknown, *J.B.Cleland 190*, c. 1912-13 (NSW).

***Flowering period***: Flowers late winter–spring.

***Distribution and habitat***: Occurs in the Badgingarra region a few hundred kilometres north of Perth in far western Western Australia (Fig. 5). Grows in pale sands in heathy woodland.

***Notes***: A rare, colony-forming species with numerous small above-ground tufts arising via vertical stems from deep horizontal rhizomes. Flowers are held well above the leaves. Leaflets show some resemblance to those of *Paragoodia crenulata* in terms of apiculum size, raised abaxial venation and an indumentum of scattered long spreading hairs. An image of *P. pusillum* is shown in figure 6. Distinctive floral features of *P. pusillum* include the ciliolate apex of the keel, downcurved wings, and a very large stigma. The shape of the ovary suggests that the pod would be similar to those in *Muelleranthus* and *Aenictophyton*.

## 4. *Aenictophyton* A.T.Lee, *Contr. New South Wales Natl. Herb.* 4(7): 422 (1973)

***Type***: *A. reconditum* A.T.Lee

*Erect or sprawling herbaceous perennials or green-stemmed shrubs* to c. 80 cm high, with stems rising from deep horizontal rhizomes; above-ground parts glabrous or with a short pubescence; branches to c. 3 mm in diameter. *Stipules* lanceolate, fleshy, green or soon stramineous. *Leaves* unifoliolate or imparipinnate, sometimes caducous, petiole (and rachis if imparipinnate) stout and green (resembling branches) beyond pulvinus; leaflets mostly much longer than broad; upper surface not gland-dotted; lower surface with secondary veins generally slightly raised. *Inflorescences* of terminal, indeterminate, pedunculate

**Key to species of *Aenictophyton***

1 Leaves 5–15-foliolate ..... **4a. *A. anomalum***

1: Leaves unifoliolate ..... **4b. *A. reconditum***

racemes; primary raceme mostly several-flowered; secondary racemes shorter, fewer-flowered; flowers developing progressively; bract and bracteoles variably persistent; bracteoles inserted proximally to distally on pedicel. *Flower-buds* with apex pointed; hypanthium c. cylindrical, with nerves raised; hypanthium and calyx red-striped longitudinally; calyx-lobes c. equal to or longer than tube, subulate; upper lobes fused for ⅓ to ½ of length; lower lobes triangular; standard and wings slightly longer than keel; standard with red-brown stripes abaxially, wings and keel variously streaked reddish; keel c. right angled between apex and upper margin; anther connective slender; ovary 6–10-ovulate; stigma small. *Pods* with stipe subequal to or longer than calyx; body elliptic or oblong-elliptic in profile, lacking pigmented patches. *Seeds*: aril small, with lobe slightly to moderately curved or rudimentary.

***Notes***: *Aenictophyton* is a genus of two species extending from far north-western Australia ESE through central Australia and into far north-western New South Wales. The genus is characterised by a shrubby habit, terminal, several-flowered indeterminate inflorescences, a long cylindrical hypanthium, a striped hypanthium and calyx, and a keel with an angular apex. Its closest relative is likely to be *Ptychosema* q.v.

### 4a. *Aenictophyton anomalum* (F.Muell.) I.Thomps., *comb. nov.*

*Ptychosema onomolum* F.Muell., *Frogm.* 9: 62 (1875)

***Type***: Northern Territory. Mt Olga, *E.Giles*, 1873–4; lectotype: MEL26461, *fide* A.T.Lee, *Contr. New South Wales Notl. Herb.* 4(7): 416 (1973); isolectotype: MEL26462.

*Plants* to c. 30 cm high, with fine appressed or spreading hairs 0.2–0.5 mm long. *Stipules* lanceolate, mostly 1–2 mm long, 0.4–0.8 mm wide, to 4 mm long on lower stems, herbaceous. *Leaves* mostly 7–15-foliolate, to c. 50 mm long; petiole base pulvinate, most of petiole and rachis herbaceous, fleshy, branch-like; leaflets opposite or occasionally a small proportion alternate, elliptic, broad-elliptic, obovate or cuneate, narrow-oblong to c. linear when folded, 2–10 mm long; apex rounded to truncate, apiculate; upper surface green, variably glabrescent. *Primory inflorescences* few to several-flowered; bract 1–2.5 mm long; pedicels 2–4 mm long, not green, hairy, becoming recurved; bracteoles 0.8–2 mm long, 0.2–0.3 mm wide, inserted 1–2 mm below receptacle. *Hyponthium* 1.5–3 mm long; calyx 3–4.5 mm long, with a sparse indumentum of short appressed hairs; lobes shorter than tube; standard 7–9 mm long, 6–7 mm wide; wings 5–9 mm long, c. 2 mm wide; keel 5–7 mm long, c. 3 mm wide; anthers c. 0.3 mm long; style c. 2 mm long. *Pods* with stipe equal to or shortly exceeding calyx; body elliptic, 10–20 mm long, 4–6 mm wide, sometimes with red-brown blotches or speckles, mostly 1- or 2-seeded. *Seeds* 3 mm long; aril minute, with a vestigial lobe.

***Selected specimens of c. 30 examined***: **WESTERN AUSTRALIA:** Walter James Range, road to Tjukurla, *H.P.Vonow 3114 & V.T.Clarke* (AD, PERTH). **NORTHERN TERRITORY:** 27 km E of Docker Settlement, *J.R.Maconochie 1849*, 26.viii.1973 (AD, BRI, CANB, MEL209332B, NSW, PERTH); c. 3 km NE of Ayers Rock, *N.M.Henry 469* (AD, DNA, MEL2093327, PERTH); 7 km SW of Reedy Rockhole, *P.K.Latz 8772*, 13.viii19B1 (CANB, DNA). **SOUTH AUSTRALIA:** Birksgate Range, near Atuti Hill, W of Mt Lindsay, *P.D.Canty 8523-39296* (AD). **NEW SOUTH WALES:** 'Nulty Springs', Enngonia, c. 60 km NE of Bourke, *G.M.Cunningham & P.L.Milthorpe 4165*, 20.xi.1975 (NSW); 'Burrawantie', *W.E.Mulham 1107*, 1B.viii.1977 (CANB, NSW); c. 6 km NE of Cumborah on Lightning Ridge Rd, *G.M.Cunningham & P.Mulham 1962*, 17.iii.1974 (NSW); Lednapper Crossing Rd, 900 m from 'Beulah' entrance towards Bourke, *B.A.Bell 128 & S.Donaldson*, 29.ix.1999 (CANB).

***Flowering period***: Flowers late winter to spring.

***Distribution and habitat***: Occurs in two widely disjunct zones, one in far south-western Northern Territory and adjacent parts of Western Australia and far north-western South Australia, the other in far northern New South Wales (Fig. 7). Grows in red sand on dunes associated with *Triodia pungens*.

***Notes***: Leaflets are variable in shape and often have raised pinnate, forward-angled secondary venation. Pairs of leaflets are inserted quite close together towards the upper midline of the rachis rather than at the sides (Fig. 8a). In a specimen from near Uluru (Ayers Rock), in the Northern Territory (*Lozorides & Polmer 293* CANB), a small proportion of leaves have alternate lateral leaflets. A specimen from Cumborah in New South Wales (*Cunninghom & Mulhom 4162* NSW) differs from other specimens in being virtually glabrous and having longer leaflets. This form warrants further investigation.

*Aenictophyton onomolum* is transferred here from

*Ptychosema* based on a suite of similarities it shares with other species of *Aenictophyton*, including inflorescence architecture, shape of the hypanthium, shape of calyx lobes, striping of the hypanthium and calyx, and relative lengths of the petals. A flower is shown in figure 8b and can be compared to a flower of *A. reconditum* shown in figure 8d. The imparipinnate leaves of *A. anomalum* are very similar to those of *Ptychosema pusillum*; however its floral morphology is markedly different to that of the latter. An imparipinnate leaf may be interpreted as a primitive feature for a clade comprising *Ptychosema* and *Aenictophyton*, in which case the reduction in leaflet number in *A. reconditum* may then be interpreted as a derived feature. Leaf, inflorescence and flower morphology of *A. anomalum* are shown in figure 8a–c.

Although designating MEL 26461 as the holotype of *P. anomalum*, Lee (1973) effectively lectotypified this specimen from two possible sheets. In her paper, Lee did not discuss her reasons for selecting one sheet over the other. Her choice is considered suitable.

### 4b. *Aenictophyton reconditum* A.T.Lee, *Contr. New South Wales Natl. Herb.* 4(7): 422 (1973)

***Type***: Northern Territory. Willis Rockhole, c. 30 miles [48 km] E of Sandy Blight Junction, *W.H.Butler 110*, v.1967; holotype: PERTH01003585; isotype: PERTH01003593.

*Plants* to c. 80 cm high, glabrous or with fine spreading hairs to c. 0.2 mm long on most surfaces, variably glabrescent. *Stipules* narrow-triangular, mostly 1–2 mm long, 0.2–0.7 mm wide, to c. 5 mm long on stems and sometimes dentate, coriaceous, pale brown. *Leaves* tending to become lost with age, to c. 40 mm long on stems but much smaller on shorter branches; petiole 1–4 mm long; leaflet narrow oblong-elliptic to linear, to c. 35 mm long, to 4 mm wide, flat or concave, with apex sometimes recurved. *Primary inflorescences* several-flowered; bract 1–3 mm long; pedicels mostly 1–2(–3) mm long, glabrous or hairy, becoming strongly recurved, or rarely (in putatively aberrant plants) 3–15 mm long and straight; bracteoles 1–1.5(–2) mm long, 0.2–0.5 mm wide, inserted 0.5–1 mm below receptacle, or rarely up to 6 mm below when the pedicel is long. *Hypanthium* 1.5–2 mm long; calyx 3–5 mm long, with a scattered indumentum of short spreading hairs or glabrous, or with very few appressed hairs; lobes as long as or slightly longer than tube; standard 5–10 mm long, 5–9 mm wide; wings 5–9 mm long, 1.5–2 mm wide; keel 5–8 mm long, 2–2.5 mm wide; anthers 0.3–0.4 mm long; style 1.5–2.5 mm long. *Pods* with stipe 4–8 mm long, equal to or more often clearly exceeding calyx; body narrow-oblong or oblong-elliptic, 12–25 mm long, 3.5–5 mm wide, 1–4-seeded. *Seeds* broad-ellipsoid, c. 2.5 mm long; aril c. 0.3 mm long, to 0.4 mm high, with a curved lobe.

***Notes***: Flowers of *A. reconditum* and *A. anomalum*

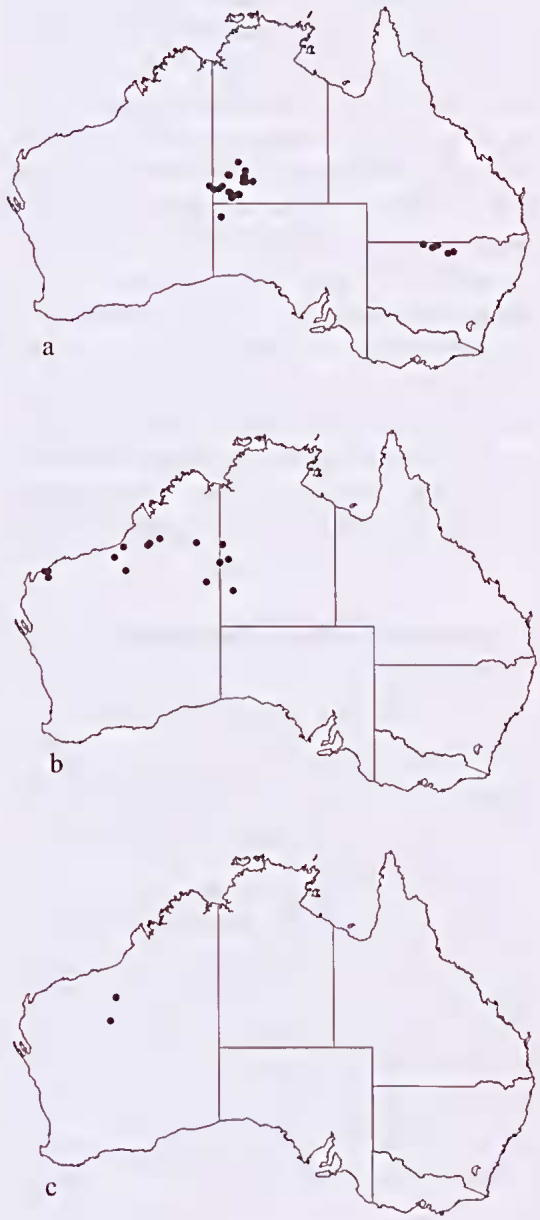


**Figure 7.** Distributions of a. *Aenictophyton anomalum*, b. *A. reconditum* subsp. *reconditum*, and c. *A. reconditum* subsp. *mocrophyllum*.

**Key to subspecies of *A. reconditum***

1 Plants pubescent with short spreading hairs, variably glabrescent; pedicels hairy at flowering; leaves < 2 mm wide ..... subsp. ***reconditum***

1: Plants ±glabrous (sparse appressed hairs on new growth only); pedicels glabrous at flowering; largest stem leaves > 2 mm wide ..... subsp. ***macrophyllum***

can be compared in figures 8b & 8d. Pod and seed morphology are shown in figures 8e–f. Aril morphology is similar to that of species of *Muelleranthus* (with the exception of the exarillate *M. stipularis*; see figures 4k & 4m). At maturity, funicles in pods of *A. reconditum* are directed strongly retrorsely, more so than has been seen in other species of the study group.

Two subspecies are recognised.

### *Aenictophyton reconditum* subsp. *reconditum*

*Plants* pubescent with short spreading hairs, variably glabrescent. *Leaves* to c. 25 mm long, to c. 2 mm wide. *Pedicels* hairy at flowering. *Calyx* 3–4.5 mm long, with a scattered indumentum of short spreading hairs; lobes c. as long as tube, upper lobes with filiform points to c. 0.5 mm long.

***Selected specimens of c. 20 examined*: WESTERN AUSTRALIA**: Airstrip Bore, NW of Lake Mackay, *M.G.Corrick 11102* (CANB, MEL, PERTH); Dragon Tree Soak, Great Sandy Desert, *A.S.George 14787*, 10.viii.1977 (CANB, PERTH); Parry Range Walk, 16 km SSW of Cane River Station, 80 km E of Onslow, *D.J.Edinger 1661*, 27.v.1999 (PERTH); 11 km E of Kiwirr kurra, Gibson Desert, *P.K.Latz 15772*, 5.xi.1998 (CANB, DNA). **NORTHERN TERRITORY:** c. 48 km W of Mongrel Downs HS, *R.Maconochie 984* (AD, DNA, NSW); Tanami track c. 472 km NW of Alice Springs, *P.A.Fryxell, L.A.Craven & J.McD.Stewart 4500*, 25.v.1985 (CANB, MEL274528); Lake Mackay, on island in SE of lake, *P.K.Latz 12898*, 11.x.1992 (CANB, DNA, MEL278780); c. 43 km SW of Inningarra Range, *J.Maconochie 936*, 2.viii.1970 (BRI, NSW).

***Flowering period***: Flowers winter and spring.

***Distribution and habitat***: Occurs in northern Western Australia and far western Northern Territory (Fig. 7). Grows in red sand dunes in open shrublands and grasslands in deserts.

***Notes***: Flowers of *A. reconditum* and *A. anomalum* can be compared in figures 8b & 8d. Pod and seed morphology are shown in figures 8e–f. Aril morphology is similar to that of species of *Muelleranthus* (with the exception of the exarillate *M. stipularis*; see figures 4k & 4m). At maturity, funicles in pods of *A. reconditum* are directed strongly retrorsely, more so than has been seen in other species of the arid genera.

Three collections of *A. reconditum* subsp. *reconditum* from widely separated locations, near Onslow, (*Edinger 1661* PERTH), Gibson Deset, (*Latz 15772* CANB, DNA), and the Inningarra Range, (*Maconochie 936* NSW), comprise multiple pieces which show a marked dichotomy in pedicel morphology. Pedicels are long and erect in some pieces but short and recurved, as is typical of the species, in the remaining pieces. Although the plants with long, erect pedicels possibly represent a distinct taxon, it is also quite possible that the plants are merely aberrant forms that occasionally develop in this subspecies of *A. reconditum*. Until further information is available it is thought prudent to not taxonomically recognise this form.

Mature seeds have not been recorded for this atypical form. In the collection from near Onslow, the piece with the atypical pedicels also has numerous semi-developed pods. These may represent pods of unfertilised flowers, and they may have reached their final size. In *Maconochie 936* the atypical piece bears a few pods that are more developed and are of a size typical of the species; however, they do not appear to have any developing seeds inside.

### *Aenictophyton reconditum* subsp. *macrophyllum* **I.Thomps.,** *subsp. nov.*

*A subspecie typica plantis glabratis, foliis majoribus differt.*

***Type***: 20.1 km SE of Burranbar Pool on Savory Creek, Little Sandy Desert, Western Australia, *S. van Leeuwen 3267*, 19.viii.1997; holotype: PERTH07015100; isotype: DNA186222, CANB713747, *n.v.*

*Plants* glabrous except for appressed hairs on newest growth. *Leaves* to c. 40 mm long, to 4 mm wide, with largest leaves 2–4 mm wide. *Pedicels* glabrous at flowering. *Calyx* 4–5 mm long, glabrous or with a few


**Figure 8.** *Aenictophyton*. a–c. *A. anomalum*: a. leaf (*M.Lazarides & J.Palmer 293* CANB), b. flower, c. raceme (b & c. *P.K.Latz 15636* DNA-NT). d–f. *A. reconditum* subsp. *reconditum*, d. flower (*A.S.George 14787* PERTH), e. pod (*P.K.Latz 15772* CANB), f. seed (*P.A.Fryxell 4500* CANB). g. *A. reconditum* subsp. *macrophyllum*, leaf and nodal region (*G.Davis 120* CANB). Scale bars: a = 10 mm, b, d = 2 mm, c, e, g = 5 mm, f = 0.5 mm.

lines of short, appressed hairs in distal half; lobes slightly longer than tube; upper lobes with filiform points c. 0.5–1 mm long. *Seeds* not seen.

***Remaining specimen examined***: **WESTERN AUSTRALIA**: SW of Nullagine and NE of Noreena Downs Stn, *G.Davis 120*, 10.viii.1979 (CANB, PERTH).

***Flowering period***: Flowers recorded July and August.

***Distribution and habitat***: Occurs in central Western Australia east and north-east of Newman (Fig. 7). Grows in skeletal red soils in lateritic hills in low open woodland.

***Etymology***: The subspecific epithet refers to the relatively large leaves (From Greek: *macros*, large and *phyllon*, leaf).

***Notes***: *Aenictophyton reconditum* subsp. *macrophyllum* is known from only two collections but is considered sufficiently distinct to warrant recognition at the level of subspecies. It has larger leaves than the type subspecies and plants are glabrous apart from scattered, appressed caducous hairs on new growth. The flowers are a little larger and calyx-lobes have longer filiform tips. A portion of a stem leaf of *A. reconditum* subsp. *macrophyllum* is shown in figure 8g.

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